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Frost Damage to Corn and Soybeans

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Recommended Citation

Hurburgh, Charles R. Jr. and Benson, Garren O., "Frost Damage to Corn and Soybeans" (2007). *Agriculture and Environment Extension Publications*. 133.
http://lib.dr.iastate.edu/extension_ag_pubs/133

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Frost Damage to Corn and Soybeans

Freezing temperatures before physiological maturity will damage corn and soybeans. Maturity in corn occurs when kernels form a black layer at the kernel tip, grain will be at approximately 30 to 35 percent moisture. Maturity in soybeans occurs when beans in pods turn yellow and are no longer green. After maturity, no additional dry matter will be accumulated in the seed.

In addition to creating quality problems, premature frost will reduce the yield of dry grain.

Corn

Characteristics of Frost-Damaged Corn

- Small, misshapen, soft kernels
- Undeveloped starch structure; pithy kernels
- Test weights progressively below 52 lb./bu., depending on maturity (in 1993, some corn was less than 40 lb./bu.)
- Average protein (7.5 to 8.0 percent) in corn heavier than 45 lb./bu., lower protein in corn lighter than 45 lb./bu.
- High breakage susceptibility; many fines generated in handling
- Lower digestibility compared with normal corn, especially for test weights below 45 lb./bu.
- Little or no increase in test weight after drying
- Variable amino acid levels
- Moisture meters generally read low in immature corn

Surface drying of kernels, giving deceptively low (by 1 to 2 percent) moisture readings on dried corn

Recognize that these effects are progressive, with least impact on corn closer to maturity.

Uses for Frost-damaged Corn

Animal feed is the best use for frost-damaged corn. Low test weight corn used for large animal

feed is only slightly less valuable (2 to 5 percent) than normal corn on a per-pound basis. Poultry, however, with limited volumetric capacity, may be more sensitive to frost-damaged corn than larger livestock.

Before feeding, test light corn for protein level, amino acid level, and mycotoxins (especially fumonisin and vomitoxin). Composition will vary. Be aware that fungi invade stressed corn more readily than they do normal corn.

Wet, dry milling, and dry grind ethanol operations will not want frost-damaged corn. Using frost-damaged corn in wet milling causes low starch yields, and the separation of starch and protein cannot be clean. In dry milling, frost-damaged corn sharply reduces yields of dry mill grits. Processors will discount light corn more heavily than its reduction in feed value. Fermentation will be more variable in ethanol production, with lower yields and less predictable distillers grain quality.

Handling and Storage

Frost-damaged corn breaks easily and goes out of condition quickly, even at low moisture levels. Dry frost-damaged corn at reduced air temperatures (below 160°F) and store at 14 percent (or lower) moisture. Expect storage life to be about half as long as that of normal corn. Do not harvest through low-lying frost damaged areas. The mixture will be a high storage risk. Harvest and handle them separately.

Because immature corn kernels dry on the surface, expect the moisture level of stored corn to be higher than test results. Expect to aerate the stored corn frequently. Move immature corn to market before summer. Store only clean corn and pull out the fines-laden center core of grain in bins.

Soybeans

Characteristics of Frost-damaged Soybeans

- Green or elongated yellow soybeans that shrink to smaller than normal size after drying
- Reduced extractable oil content (below 16 percent), difficult extraction of oil, and poor oil quality
- Higher moisture level (by 1 to 2 percent) than indicated by moisture meters
- Slower field drydown

Beans often lose their green color within two weeks of maturity, so allow field drydown if at all possible. This same statement is true of plants that were only partially frosted (generally on upper leaves).

Uses for Frost-damaged Soybeans

Processors will discount green soybeans based on the color definition in the U.S. Grades. The greenness of immature soybeans must be refined out of the oil. Oil from immature beans often contains high levels of free fatty acids, which are causes of rancidity. Meal from immature soybeans will contain more residual oil than the normal 0.5 to 1.0 percent.

Storage and Handling

Because immature soybeans are deceptively wet, conditions problems often occur. Clean soybeans before storage to remove wetter weed seeds and plant parts. Two to four weeks of steady aeration will both reduce moisture levels and cause greenness to partially subside. Check the condition of stored soybeans frequently. You can artificially dry soybeans, but use temperatures of less than 130°F, which are considerably lower than temperatures used for corn drying.

Direct marketing from the field will probably create the highest discounts for green soybeans; the market often overreacts to stress situations.

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File: Engineering 2

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